CARBON IN SEDIMENTS AT THE KT BOUNDARY SITE OF THE BRAZOS RIVER, TEXAS.

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Three forms of carbon were found to be strongly enriched at several Cretaceous-Tertiary (KT) boundary sites, namely elemental carbon [1], soot [1], and fullerenes [2]. Each of these has been proposed to have formed in global wildfires following the Chicxulub impact event at the end of the Cretaceous. Until the present work, no joint studies of all three geochemical markers had been done at any KT site in the western hemisphere. We have chosen for our work the Brazos-1 (BR1) section of the Brazos River complex because it is the most complete section of end-Cretaceous and basal Paleocene deposits for the Texas segment of the Gulf Coast [3]. As was the case at other KT boundary sites, carbon (22 ‰) and soot (14 ‰) were found to be greatly enriched at BR1 in a thin sandy bed which contains the paleo-defined KT boudary. Sub-ppb amounts of C_{60} were also found in this bed. We suggest that the Chicxulub impact ignited local wildfires; that carbon, soot and fullerene settled onshore, or near-shore, whence they were transported to the Brazos site by coastal flooding and associated sediment-laden water plumes moving offshore.

Thirteen samples from different locations of the BR1 section as shown in Figure 1 were treated for the determination of elemental carbon and soot by procedures described before [1]. Table 1 lists the results. Figure 1 shows the BR1 section, the location of the samples studied and the carbon and soot contents.

The search for fullerenes was done in more than thirty samples by procedures described before [2]. The only results for which both the High Performance Liquid Chromatography (HPLC) retention times and C_{60} absorption spectra matched the values of synthetic C_{60} were obtained for three samples from the SB bed where the amounts of C_{60} found were in the range 0.1 to 0.6 ppb (no C_{70} was detected), typically one to two orders of magnitude smaller than those found at other KT sites [2].

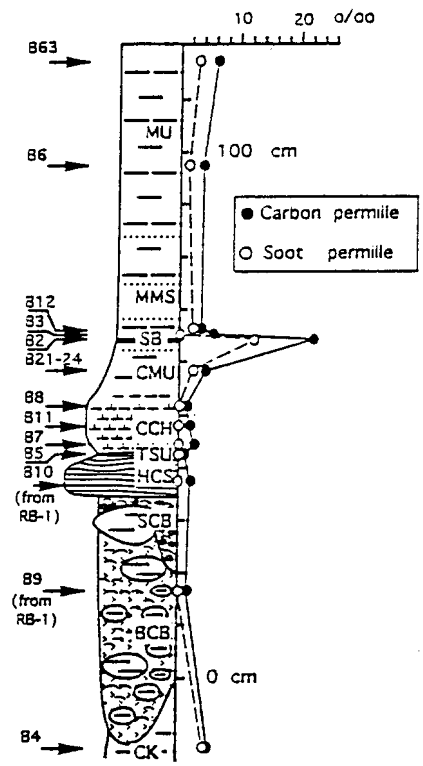

Figure 1. Stratigraphy, carbon and fullerene contents in sediments of the Brazos-1 section. Note that one maximum of carbon and soot occurs in bed SB. C_{60} was found here also. Unit designations are presented in the companion paper [6].

Table 1. Carbon and soot contents of samples from the BR1 section.

UNIT	SAMPLE	CARBON (‰)	SOOT (‰)
MU	B63	6.1 ± 0.9	3.0 ± 0.4
MU	B6	4.0 ± 0.5	1.6 ± 0.2
MMS	B12	3.8 ± 0.6	2.4 ± 0.3
MMS	B3	5.8 ± 0.7	0.04*
SB	B2	22 ± 2	14 ± 1
CMU	B21-B24#	4.3 ± 0.5	2.4 ± 0.03
CCH	B8	1.4 ± 0.12	0.041*
CCH	B11	2.1 ± 0.4	0.038*
TSU	B7	2.8 ± 0.8	0.036*
TSU	B5	9.8 ± 0.37	0.28 ± 0.1
HCS**	B10	2.1 ± 0.3	0.029*
BCB**	B9	1.6 ± 0.4	0.032*
CK	B4	4.8 ± 0.6	4.0 ± 0.5

* upper limit of detection. # combination which represents the bulk of CMU unit.
** from equivalent beds of the nearby RB1 riverbed section.

The spherules of unit SCB are the earliest material markers in the section from the Chicxulub event. They were probably transported by the ejecta curtain mode [4] and arrived at Brazos soon after the impact. Neither the SCB, nor the HCS, nor the CCH units are known to contain Ir anomalies, or any of the geochemical markers studied here. All of these geochemical markers occur in the TSU, CMU, SB, and MMS units above HCS. Most of the section up to MMS is fining upwards and is thought to have settled within hours or days in a quieting water column [5]. There occur three iridium maxima above unit HCS. The lowermost two (in TSU and CMU units) are not accompanied by increases in carbon and soot. The highest Ir anomaly straddles bed SB which is Ir-poor. This probably represents continuous sedimentation of very fine-grained, Ir-enriched materials, transiently interrupted by the arrival of faster-settling, but Ir-poor sandstone grains of bed SB.

We posit that the carbon and soot in bed SB come from wildfires as was suggested for these markers at other KT sites globally [1]. Our preferred hypothesis is that the carbon and soot in bed SB came from comparatively early local wildfires. Some carbon and soot could have settled directly onto the seafloor from airfall or flood-generated thermohaline water-plumes, but the bulk was carried to the BR-1 site by sediment-laden density currents. Bed SB is the deposit of a density current capable of moving and depositing small sand grains.

References: [1] Wolbach W. S. et al. (1990), GSA Spec. Pap. 247, 391. [2] Heymann D. et al. (1996) GSA Spec. Pap. 307, 453. [3] Jiang M. J. and Gartner S.(1986) Micropaleontology 32, 232; Yancey T. E. (1996), Trans. Gulf Coast Ass. of Geol. Soc. 46, 433.[4] Alvarez W. (1996) GSA Spec. Pap. 307, 141. [5] Smit. J. et al. (1996) GSA Spec. Pap. 307, 151. [6] Heymann D. et al. (1997), these abstracts.